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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/763,396	01/26/2004	Michael R. Feldman	280/100	4578

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EXAMINER	
LE, TUAN H	

ART UNIT	PAPER NUMBER
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/763,396	FELDMAN ET AL.	
	Examiner	Art Unit	
	Tuan H. Le	2622	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *26 January 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-24* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-24* is/are rejected.

7)☒ Claim(s) *10,11,13 and 21* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *26 January 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

Claim 3 is objected to because of the following informalities: "the order" should be changed to "an order". Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 10 and 11 recite the limitation of "the filter". There is insufficient antecedent basis for this limitation in the claim.

Claim 13 recites the limitation of "the path". There is insufficient antecedent basis for this limitation in the claim.

Claim 21 recites the limitation of "two substrates". There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 102

> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-6,22,24 are rejected under 35 U.S.C. 102(a) as being anticipated by "Thin observation module by bound optics (TOMBO): concept and experimental verification/ 10 April 2001/ Vol. 40, No. 11/ Applied Optics 1806. This reference is referred to asTanida I.

Regarding **claim 1**, Tanida I discloses an imaging system comprising:

an array of lenses (Tanida I, Fig. 3a and Tombo Architecture 3A, wherein a microlens array is disclosed);

a plurality of sensors for each lens (unit), each sensor having a single detection element of size p.sub.xp.sub.y, with the center-to-center spacing of the detection elements being dx in the x-direction and dy in the y-direction, the plurality of sensors being adjacent to an image plane of a corresponding lens(Tanida I, Fig. 3a and Tombo Architecture 3A, wherein each microlens sends optical signals to multiple photosensitive cell); and

a plurality of macro-pixels of size dxdy, each macro-pixel corresponding to a sensor and being between the corresponding lens and the sensor, each macro-pixel having mxmy micro-pixels, each micro-pixel being of size dx/mx*dy/my and having one of a high and a low transmittance function (Tanida I, Fig. 3a, Tombo Architecture A, and Experimental Tombo system 4, wherein stainless-steel plates are used for micro-pixels, cell size is 11μm x 11μm, and squared-shaped holes with hole diameter is 15 μm),

wherein light transmitted through each lens and directed towards a sensor will impinge on the sensor after multiplication by the transmittance of the macro-pixel (Tanida I, Fig. 3a, Tombo Architecture A, and Experimental Tombo system 4, wherein after the lens, light passes the holes), and

wherein the imaging system has a resolution in the image plane of greater than 1/px in the x-direction or 1/py in the y-direction (Tanida I, Fig. 3a, Tombo Architecture A, and Image-Retrieval Methods 5, wherein when applied to the TOMBO system, back-projection method achieves higher image resolution the the sampling method).

Regarding **claim 2**, Tanida I discloses the imaging system of claim 1. In addition, Tanida I discloses that a ratio of a size of each macro-pixel to a size of each micro-pixel is proportional to a number of lenses in the array of lenses (Tanida I, Fig. 3a, Tombo Architecture A, and Experimental Tombo system 4, wherein cell size is 11μm x 11μm and squared-shaped holes whose hole diameter is 15 μm, thus this ration is proportional to a number of lens in the array of lenses).

Regarding **claim 3**, Tanida I discloses the imaging system of claim 1. In addition, Tanida I discloses that the size dx/mx*dy/my is on the order of a desired resolution of the imaging system, (Tanida I, Fig. 3a, Tombo Architecture A, and Experimental Tombo system 4, wherein squared-shaped holes with hole diameter is 15 μm are used for the resolution 739x575).

Regarding **claim 4**, Tanida I discloses the imaging system of claim 1. In addition, Tanida I discloses that all m micro-pixels for a corresponding macro-pixel have high transmittance, (Tanida I, Fig. 3a, Tombo Architecture A, and Experimental Tombo system 4, wherein squared-shaped holes with hole diameter is 15 μm are used).

Regarding **claim 5**, Tanida I discloses the imaging system of claim 1. In addition, Tanida I discloses that only one micro-pixel for a corresponding macro-pixel has high transmittance, (Tanida I, Fig. 3a, Tombo Architecture A, and Experimental Tombo system 4, wherein cell size is 11μm x 11μm and squared-shaped holes whose hole diameter is 15 μm, and the macro pixel transmits all incoming light.

Regarding **claim 6**, Tanida I discloses the imaging system of claim 1. In addition, Tanida I discloses that a number of lenses in the x-direction is different from the number of lenses in the y-direction (Tanida I, Fig. 3a, Image-Retrieval Methods 5, wherein Tombo system is 32x25 units).

Regarding **claim 22**, Tanida I discloses the imaging system of claim 1. In addition, Tanida I discloses dxdy=pxpy, (Tanida I, Fig. 3a, Tombo Architecture A, and Experimental Tombo system 4, wherein stainless-steel plates are used for micro-pixels, cell size is 11μm x 11μm, and squared-shaped holes with hole diameter is 15 μm).

Regarding **claim 24**, Tanida I discloses the imaging system of claim 1. In addition, Tanida I discloses a processor receiving outputs from the plurality of sensors and combining outputs from corresponding sensors for different lenses (Tanida I, Fig. 7 and Fig. 11, wherein it is inherent that a processor is used to produce final image from multiple images).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 7-9,23 are rejected under 35 U.S.C. 103(a) as being obvious over "Thin observation module by bound optics (TOMBO): concept and

experimental verification/ 10 April 2001/ Vol. 40, No. 11/ Applied Optics 1806. This reference is referred to asTanida I.

Regarding **claim 7**, Tanida I does not discloses the high transmittance is one and the low transmittance is zero.

However, it is obvious to an artisan to define high transmittance is one and the low transmittance is zero because such definition clearly determines the transmittance in order to simplify processing.

Regarding **claim 8**, Tanida I discloses high transmittance is greater than 0.5 and the low transmittance is less than 0.5.

However, it is obvious to an artisan to define high transmittance is greater than 0.5 and the low transmittance is less than 0.5 because such definition clearly classifies incoming light and increases amount of incident light.

Regarding **claim 9**, Tanida I discloses high transmittance micro-pixels in macro pixel.

However Tanida I does not disclose at least 20% high transmittance micro-pixels.

On the other hand, it is an artisan's choice of designing at least 20% high transmittance micro-pixels.

Therefore, it would have been obvious to an artisan to incorporate the percentage of high transmittance micro pixels into the imaging device as described by Tanida I because such high transmittance micro pixel increase image contrast.

Regarding **claim 23**, Tanida I discloses the imaging system of claim 1. In addition, Tanida I discloses corresponding macro-pixels and sensors fill in similarly sized area of lens.

However Tanida I does not disclose polygonal lens.

On the other hand, it is an artisan's choice of design an array of microlens as polygonal lenses.

Therefore, it would have been obvious to an artisan to incorporate the polygonal microlens into the imaging device as described by Tanida I because such an array of polygonal lens reduces dead space in the microlens array.

Claims 10-14,16-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tanida I in view of Tanida II (U.S. Pat. 7,009,652).

Regarding **claim 10,** Tanida I discloses the imaging system of claim 1. In addition, Tanida I discloses is formed on one side of a substrate.

However, Tanida I does not disclose the filter is formed on an opposite side of the substrate.

On the other hand, Tanida II discloses the filter is formed on an opposite side of the substrate (Tanida II , column 6 lines 35-37, wherein the polarized filter is at photosensors).

Therefore, it would have been obvious to an artisan to combine the filtering element as described by Tanida II et a with the imaging system as described by Tanida I in order to separate adjacent signals because such combination does not increase thickness for separation layer.

Regarding **claim 11**, Tanida I discloses the imaging system of claim 1. However, Tanida I does not disclose the filter is formed on the lens.

On the other hand, Tanida II discloses a polarizing filter arrays are arranged at a micro-lens array surface, (Tanida II , column 6 lines 35-37).

Therefore, it would have been obvious to an artisan to combine the polarizing filter arrays as described by Tanida II with the imaging system as described by Tanida I in order to separate adjacent signals because this combination does not increase the thickness of a separation layer.

Regarding **claim 12**, Tanida I discloses the imaging system of claim 1. However, Tanida I does not disclose at least part of a path between the lens and the array of macro-pixels has a refractive index greater than one.

On the other hand, Tanida II discloses at least part of a path between the lens and the array of macro-pixels has a refractive index greater than one, (Tanida II , Table 2 and column 5 lines 28-47).

Therefore, it would have been obvious to an artisan to combine the refractive lens with index higher than one as described by Tanida II with the imaging system as described by Tanida I in order to reflect incident light because such high index reduces the thickness of the separation layer.

Regarding **claim 13**, Tanida I discloses the imaging system of claim 10. However, Tanida I does not disclose a majority of the path has a refractive index greater than one.

On the other hand, Tanida II discloses a majority of the path has a refractive index greater than one.

Therefore, it would have been obvious to an artisan to combine the refractive lens with index higher than one as described by Tanida II with the imaging system as described by Tanida I in order to reflect incident light because such high index reduces the thickness of the separation layer.

Regarding **claim 14,** Tanida I discloses the imaging system of claim 1. However, Tanida I does not disclose one filtering element allows all the light incident thereon to impinge on the macro-pixel.

On the other hand, Tanida II discloses one filtering element allows all the light incident thereon to impinge on the macro-pixel (Tanida II , column 6 lines 35-37, wherein the other filter at photosensors blocks incoming light).

Therefore, it would have been obvious to an artisan to combine the filtering element as described by Tanida II et a with the imaging system as described by Tanida I in order to separate adjacent signals because such combination does not increase thickness for separation layer.

Regarding **claim 16,** Tanida I and II disclose the imaging system of claim 1. In addition, Tanida II discloses the lens includes a substrate having parallel surfaces, an optical element being formed on at least one of the parallel surfaces, (Tanida II, Fig. 3C wherein diffractive lens is fabricated).

Regarding **claim 17,** Tanida I and II disclose the imaging system of claim 1. In addition, Tanida II discloses the lens includes at least two substrates having parallel surfaces, at least two optical elements, each optical element being formed on a different surface of the at least two of the parallel surfaces (Tanida II, Fig. 3C, wherein laser beam affects both sides of glass substrate G).

Regarding **claim 18,** Tanida I and II disclose the imaging system of claim 16. In addition, Tanida II discloses one optical element of the least two optical elements is a diffractive optical element (Tanida II, Fig. 3C, wherein it is a diffractive lens).

Regarding **claim 19,** Tanida I and II disclose the imaging system of claim 17. In addition, Tanida II discloses the diffractive optical element corrects for aberration of the lens (Tanida II, Fig. 3, wherein correcting aberration is inherent part of diffractive lens).

Regarding **claim 20,** Tanida I and II disclose the imaging system of claim 16. In addition, Tanida II discloses the at least two substrates for an array of lenses are bonded together (Tanida II, column 6 lines 47-50, wherein hybrid filter of diffractive element and refractive element).

Regarding **claim 21,** Tanida I and II disclose the imaging system of claim 16. In addition, Tanida II discloses a spacer between the at least two substrates (Tanida II, Fig 3C, wherein there is a distance between the two surfaces).

Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tanida I in view of "Color imaging with an integrated compound imaging system", 8 September 2003/ Vol. 11, No. 18/ Optics Express 2109. This reference is referred to asTanida III.

Regarding **claim 15,** Tanida I discloses different color filters in paths of corresponding macro-pixels.

On the other hand, Tanida III discloses color filters in paths of corresponding macro-pixels (Tanida III, Fig. 3, wherein color separation by pixels).

Therefore, it would have been obvious to an artisan to combine the color filters as described by Tanida III with the imaging system as described by Tanida I in order to separate color for pixels because such combination results in better image quality, i.e color image instead of black and white.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Robinson et al (U.S Pat. 5,616,912).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tuan H. Le whose telephone number is (571) 270-1130. The examiner can normally be reached on M-Th 7:30-5:00 F 7:30-4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David L. Ometz can be reached on (571) 272-7593. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Tuan Le/

DAVID OMETZ
SUPERVISORY PATENT EXAMINER